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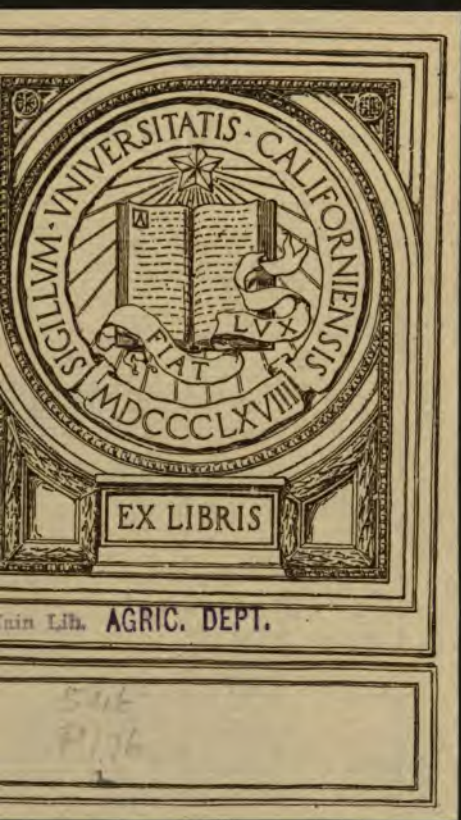
Indirect Benefits of
Sugar-Beet Culture
T. G. Palmer

UC-NRLF



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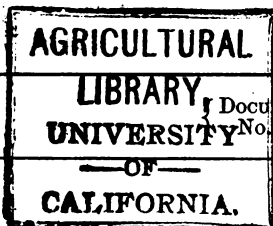
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P176

62D CONGRESS }
1st Session }

SENATE



INDIRECT BENEFITS OF SUGAR- BEET CULTURE

LETTER FROM AND DATA PREPARED BY
TRUMAN G. PALMER
" "
CONCERNING THE INDIRECT AGRICULTURAL
BENEFITS WHICH ARE DERIVED FROM
THE CULTURE OF SUGAR BEETS



PRESENTED BY MR. SMOOT
JULY 25, 1911.—Ordered to be printed

WASHINGTON

1911

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U. S. DEPT. OF JUSTICE
WASHINGTON, D. C.

A. I. L.

U.S. DEPT. OF AGRICULTURE
BUREAU OF PLANT INDUSTRY

INDIRECT BENEFITS OF SUGAR-BEET CULTURE.

WASHINGTON, D. C., July 17, 1911.

HON. REED SMOOT,
United States Senate, Washington, D. C.

MY DEAR SENATOR: In accordance with your suggestion, I inclose herewith some data which I have prepared on "The increased yield of other crops due to rotation with sugar beets," a subject of vital interest not only to the people of your State, but to the Nation.

To handle this subject, it becomes necessary to compare the crop yields of Europe and the United States, and the regrettable feature about it is that such comparison does not contribute to one's national pride.

A recent magazine article which dealt in glittering generalities was put out under the caption, "The United States feeding the world." One of the statements made was that when we shipped our cotton to Europe we sent with it the food products to feed the starving workmen who made it into fabrics and laces.

One phase of our all too prevalent vulgar boastfulness would be cured if we but realized that Europe, without Russia ("the granary of Europe"), occupying but 45 per cent of our surface area, tills double the number of acres of wheat, rye, barley, oats, and potatoes that we till, and from that double area devoted to these five crops their farmers harvest four times the number of bushels that our farmers harvest; that of these five crops Europe produces more bushels per capita for their 300,000,000 people than we do for our 90,000,000 people, and that during the past 30 years Europe has increased her acreage yield of these five crops 75 per cent, while we have increased ours but 8 per cent.

In the accompanying data I have attempted to make plain the fact, so well understood in Europe, that the remarkable economic position of that country has been brought about by the introduction of the humble sugar beet, the leaf buds and roots of which in the time of Augustus Cæsar were used as a food for slaves, and must have been considered very vulgar, since Cæsar delighted to compare slack persons with boiled mangel, "betizare" dicebat.

Although my study of the beet-sugar industry extends over a period of 15 years, during 9 of which I have been secretary of the American Beet Sugar Association, it was not until I began making study trips in Europe that the full value of the industry in its inter-related connection with general agriculture dawned upon me, and since then I have devoted a large portion of my time to a study of this particular feature of the industry.

Anybody will admit that it would be desirable to produce at home the \$180,000,000 worth of sugar we annually import from foreign countries and our island possessions, and turn this vast sum into the pockets of our own instead of foreign farmers and laborers. That in

itself would be a consideration of great economic value to the Nation, but it would be small indeed compared to the indirect benefits to be derived if we produced this sugar from beets, the cultivation of which in Germany, in rotation with wheat, rye, barley, oats, and potatoes, has resulted in their farmers securing from the land which they devote to these five crops an excess annual yield worth \$900,000,000 more than our farmers secure from a like area devoted to the same crops, and if from our total area devoted to these five crops our farmers secured as great a yield as do the German farmers our farmers would be richer by \$1,400,000,000 a year.

Fifty years ago Bassett, in his work, *Guide Practique du Fabricant de Sucre*, said:

The manufacture of sugar from beets is one of the most important elements of public prosperity. Resting on agricultural progress and the wants of a constantly increasing population, allied by reason of the cattle which it supports with the production of meat and bread, based upon improving cultivation, it renders to modern society the greatest services, at the same time that it attains for itself the highest point of prosperity and glory to which any industry ever had the ambition to aspire.

Louis Napoleon, when imprisoned at Ham, in 1842, said of the beet-sugar industry in his *Analyse de la Question des Sucres*:

It retains workmen in the country, and gives them employment in the dulllest months of the year; it diffuses among the agricultural classes good methods of culture, calling to their aid industrial science and the arts of practical chemistry and mechanics. It multiplies the centers of labor. It promotes, in consequence, those sound principles upon which rest the organization of society and the security of governments; for the prosperity of a people is the basis of public order. * * * Wherever the beet is cultivated the value of land is enhanced, the wages of the workmen are increased, and the general prosperity is promoted.

In another place the same author puts the following words in the mouth of the sugar industry:

Respect me, for I improve the soil. I make land fertile which, without me, would be uncultivated. I give employment to laborers, who otherwise would be idle. I solve one of the greatest problems of modern society. I organize and elevate labor.

In 1853, when the French Emperor and Empress came to Valenciennes, a triumphal arch was erected, with the following inscription:

SUGAR MANUFACTURE.

Napoleon I, who created it.

Napoleon III, who protected it.

Before the manufacture of beet sugar the arrondissement of Valenciennes produced 695,750 bushels of wheat and fattened 700 oxen.

Since the manufacture of beet sugar was introduced the arrondissement of Valenciennes produces 1,157,750 bushels of wheat and fattens 11,500 oxen.

Grant, in his *Beet Root Sugar and Cultivation of the Sugar Beet* (1867), says:

I have said a direct net profit of \$20 per acre, because it has been found in Europe that there is also an indirect profit on the beet crop in the large increase of crops succeeding it and in the cattle supported by the pulp. Experiments have conclusively proved that lands now yield from two to three times as much grain and support from eight to ten times as many cattle, in the beet-growing districts as they did before the beet was introduced. The great beet-producing districts of France are the grain districts and the cattle districts also. The three branches of agriculture always coexist.

If our farmers were made to know that by proper rotation the culture of 40 acres of sugar beets would increase their yield of all other crops on 160 acres from 20 to 80 per cent, you could not build factories fast enough to care for the beets they would furnish. Gradually they will find it all out for themselves, but it is a slow process.

Five years ago a beet-sugar factory was erected at Chaska, Minn., where it since has been operated each year, and as evidence of the time it takes to disprove erroneous impressions and absorb the truths which Napoleon publicly proclaimed a century ago, and which since have been proclaimed by practically every European agricultural economist of note, I quote a local notice which recently appeared in the Wabasha (Minn.) Herald. This notice says:

THE SUGAR BEETS—WHAT IS DONE FOR THE LAND—ATTENTION, FARMERS.

One of the best crops of wheat raised in this vicinity this year was that of George Hauswedel. The wheat was a fine stand of good quality and well filled out. There were 14 acres, and the result in thrashing was an average of 32 bushels to the acre. This comes as a surprise to many farmers, since the field was planted to sugar beets last year, and the impression prevails that a crop of the latter will so exhaust the soil as to yield a poor crop of grain the next year. Mr. Hauswedel, however, has demonstrated the fallacy of this supposition. We understand that the soil was given no special treatment, and no particular effort was made toward securing an exceptional result.

You see that with a factory operating in their midst for five years the erroneous impression still prevails that sugar beets exhaust the soil. Notwithstanding the contrary experience of all Europe, and of this man, and probably many of his neighbors, I have no doubt but what a canvass of the farmers about Chaska would show that the general idea concerning beet culture is that beets injure the soil, and that unless they harvest "so many tons of beets per acre at so much per ton" they will decline to grow beets. The average wheat yield of Minnesota is 13.4 bushels per acre, hence the yield quoted above was 139 per cent in excess of the average wheat yield of the State. If such a yield were secured throughout the State, it would add \$84,000,000 a year to the wealth of Minnesota wheat farmers, at 85 cents per bushel. Each increase of 1 bushel of wheat per acre in the State of Minnesota will add \$4,500,000 annually to the wealth of her wheat farmers. This result at Chaska, which is reported as being a general surprise, is but an echo of what one hears on all sides in the sugar-beets districts of Europe and what our forefathers could have heard over there 50, 75, and even 100 years ago.

Last September I visited the 7,000-acre Tachlowic estate at Yenc, 30 kilometers from Prague, Bohemia, one of the imperial estates of Emperor Francis Joseph. Sixty years ago a beet-sugar factory was erected on this estate and since that time one-third of its cultivable area has been planted to sugar beets, grown in rotation with other crops. The records of the estate show that for the 60 years since one-third of the area has been devoted to sugar beets, the remaining two-thirds has produced a greater tonnage of all other crops than did the entire three-thirds for 60 years prior to the construction of the factory, and, in addition to this, the stock-carrying capacity of the estate has been increased 100 per cent.

At Hatwan, Hungary, 60 kilometers from Budapest, I visited the 25,000-acre estate of the Barons Alexander and Joseph Hatvany, both of whom are agricultural economists of high repute throughout Europe. This estate is equipped with the largest beet-sugar factory in Europe, slicing 3,000 tons of beets per day and using the beets grown on 50,000 to 70,000 acres. While they were producing sugar at a small profit, the great inducement in operating the factory was the indirect advantages secured through beet culture. They grow 3,000 acres of beets on the estate, which they rotate with 9,000 acres of

wheat, barley, and other crops. The balance of their beets are grown on other near-by estates, the owners of which, in order to secure the rotating value of sugar beets, are only too glad to produce large quantities of high-grade beets and sell them for a fraction over one-half the average price paid for poorer beets in the United States. Their largest contractor furnishes them with 3,000 acres of beets, which average 18½ per cent sugar, and the price paid per 2,000-pound ton was at the rate of \$3.36, our money, as compared to the average price of between \$5 and \$6 per ton in the United States.

I will digress for a moment to state that this estate, formerly the property of Maria Theresa's favorite prime minister, is the most perfectly equipped and managed property I have ever visited. Aside from the 120-room palace, which in summer is occupied by the Hatvanys, there are beautiful homes for the various managers and superintendents, a small city of workmen's houses, innumerable barns of great proportions, machine shops, wagon and blacksmith shops, dairies, electric-light plant, ice plant, and everything else necessary to conduct the estate without calling on the outside world. A private narrow-gauge railway, equipped with 600 cars, taps every field. The estate is equipped with an abundance of the best agricultural machinery, including numerous steam plows, all of which is carefully housed. It is stocked with 4,000 dairy cows and work oxen, which produce great quantities of manure, and this is prized as highly and protected as carefully as is the grain, being thoroughly rotted before it is spread on the fields. Every pound of milk is shipped to Budapest. The refuse of the sugar factory is used to feed the cattle, and upon learning that American farmers about many of our beet-sugar factories would not haul the pulp away as a gift, they asked me to look the matter up and see if arrangements could not be made to dry it and sell it to them for a term of years. They raise vast quantities of wheat, but never sell a bushel, seven modern flour mills on the estate, with a capacity of 30,000 sacks a day, turning it into flour and leaving the by-products to be fed to stock. The same with the barley; a well-equipped brewery turns it into beer, leaving the by-product for stock food. One can not imagine a more scientifically managed property, where every farthing of profit is secured.

First. They secure the customary profit in producing raw cereal products.

Second. By preparing the raw material for the table and shipping nothing but what is ready for direct consumption, they secure the manufacturing profit.

Third. By feeding the by-products to their own stock instead of wasting or selling them to feeders, they secure the profit from dairying and fattening cattle.

Fourth. From their 4,000 head of dairy cows and work oxen they secure an abundance of manure with which to build up the chemical condition of their soil and make it more productive, thus securing another profit.

Fifth. By operating a sugar factory which slices the beets from 50,000 to 70,000 acres of ground, they secure the profit derived from sugar manufacture and also from the feeding value of the resultant by-products.

Sixth. By growing 3,000 acres of beets, they secure the profits of sugar-beet farming.

Seventh. By rotating beets with 9,000 acres of wheat, barley, oats, and other crops, the consequent deep plowing, thorough cultivation, and aerating effect of the beet rootlets keeps their soil in perfect physical condition and so greatly increases the yield of all other crops that this produces the greatest profit of all.

By following the above method, they are able to extract the last dollar the estate is capable of producing, and however long this method might be continued, the productivity of the soil would be maintained at its maximum. It reminded me of Armour's packing house, where he said they saved all of the hog but the squeal. The Hatvanys own two other large estates in Hungary, one of 15,000 acres, both equipped with huge up-to-date beet-sugar factories, the raw product for which furnishes the inspiration for this character of farming. This is but one of many equally well-managed European estates where sugar beets form the pivot around which all agricultural operations center.

At last, by personal experience, those of our farmers who employ correct cultural methods and who keep a record of their yields, are beginning to learn what our scientists and economists have failed to teach them concerning the improvement of the soil through beet culture. Numerous letters received from farmers in your State, as well as in other States, show this, and as showing that these beneficial effects are not confined to any one section of our country, I have produced a few letters from each of several beet-sugar-producing States.

On my next study trip to Europe I hope to conclude my researches on this phase of the sugar question, after which I will present you with something more than a boiled-down statement, such as I am inclosing herewith. I then will lay before you and your colleagues and before the country statements in extenso concerning economic facts of record, the results of a long line of experiments conducted by the most prominent agricultural scientists and economists Europe has produced during the past century, together with their conclusions, a record of my personal observations in Europe and in the United States, and the statements of such American beet farmers in the various States as have kept records of their yields and noted the increase. From the data already gathered, I am confident that I will be able to present such a quantity of indisputable evidence as to prove to any fair-minded person that by producing our sugar at home the net profits accruing to our farmers through the excess yields of other crops would exceed by many times the total value of the sugar produced, and it would seem that an industry of such potentiality for creating wealth should interest every thinking person, irrespective of party affiliations or preconceived contrary ideas of economics.

To the end that we may increase our national prosperity and at the same time lower the cost of producing our food supply, it would appear that something, anything, everything within reason should be done to force or cajole or coax our farmers to plow deep, to cultivate thoroughly, to care for their barnyard manure properly and to establish a reasonably scientific system of crop rotation, whereby the field to which they apply their energies will be made to yield as much or more than do the rejuvenated soils of Europe.

Very sincerely, yours,

TRUMAN G. PALMER.

INFLUENCE OF THE SUGAR BEET ON MODERN SCIENTIFIC AGRICULTURE.

THE FOUNTAIN HEAD OF INSPIRATION WHICH LED TO DEEP PLOWING, SCIENTIFIC ROTATION, INCREASED FERTILIZATION, THOROUGH CULTIVATION, AND DOUBLED THE ACREAGE YIELD OF ALL CROPS IN EUROPE.

[By Truman G. Palmer.]

The production of the food supply of human beings ever has been and ever will continue to be the most important consideration of man, and he who makes a given area produce a bushel and a peck where it formerly produced but a bushel is a public benefactor.

Two thousand years before the birth of modern agricultural science that science had reached a high level, and the crop yields probably were greater then than they are to-day.

One hundred and fifty years before Christ, Cato the Elder, the Roman statesman and patriot who fought Hannibal and Hasdrubal, wrote a book on farm management, a perusal of which would enlighten the average American farmer to-day and teach him how to increase the yield of his fields.

Cato proclaimed the fundamentals of good agriculture in his *De Re Rustica* when he said:

What is the first principle of good agriculture? To plow well. What is the second? To plow again; and the third is, to manure.

To the farmer who kept stock, he said:

Plan to have a big compost heap and take the best of care of manure. When it is hauled out, see that it is well rotted and spread.

And to the farmer who had no stock, he said:

You can make manure out of litter, lupine straw, chaff, bean stalks, husks, and the leaves of the ilex and oak.

A hundred years after Cato's death, Augustus Caesar made frequent mention of beets, which then were one of the principal foods for slaves, while the leaves long had been used as an auxiliary fodder for stock, and there are those who believe that, known by some other name, beets formed an important feature in Cato's crop system, just as they did after their value had been rediscovered 20 centuries later.

People forgot Cato's teaching, and when, 2,000 years later, Napoleon Bonaparte stepped upon the stage at the beginning of the nineteenth century, the worn-out soils of Europe had reached their lowest ebb in productiveness, and scientists and economists were in despair because of the insufficient food production to feed the ever-increasing population.

The genealogy of modern European scientific agriculture reaches back to the beginning of the nineteenth century only and shows that the beet-sugar industry was its father and that Napoleon Bonaparte was the father of the beet-sugar industry.

German scientists discovered the presence of sugar in the beet and perfected a method of extracting it, but Napoleon Bonaparte's chemists and economists, after 10 years of scientific research, became convinced that by growing sugar beets on a field one year in four the fertility of the soil thereby was so greatly increased that the combined yield of other crops on the same soil during the next three years was

greater than formerly it had been for four years, and it remained for Napoleon himself to grasp the tremendous significance of a discovery which could be made to serve the double purpose of solving the nation's food-supply problem and freeing it from dependence on Great Britain.

By reason of Napoleon's Berlin and Milan decrees of 1806, prohibiting the importation of colonial articles and establishing the "continental system," the price of sugar had risen to \$1 per pound, and mutterings against imperial rule were heard upon all sides; but these rumblings in no way affected the plans of Napoleon, now that he had become convinced of the indirect advantages of beet culture.

On March 11, 1811, Napoleon said in an address before the Chamber of Commerce:

Commercial relations with England must cease. I proclaim it to you, gentlemen, distinctly. * * * I am informed that from late experiments France will be able to do without the sugars and indigoes of the two Indies. Chemistry has made such progress in this country that it will probably produce as great a change in our commercial relations as that produced by the discovery of the compass.

On March 18, 1811, Napoleon dictated a note to his minister of the interior in which he said:

The minister of the interior will make a report to be sent to the council of state, in which the advantages of developing the manufacture of beet sugar will be included. All steps shall be taken to encourage this culture and if necessary by modifying the customhouse tariff for a period of five years, or even the possibility of prohibiting absolutely the importation of colonial or foreign sugars. The minister will take steps to make trials in a very extensive manner and to establish schools for teaching the manufacture of beet sugar.

The minister will apportion among the different departments 60,000 arpents (90,000 acres) of land, on which it will be necessary to grow beet roots sufficient for the entire consumption of France. The proper officers will be appointed to see that the cultivators deliver their proportions.

The minister will also advise the cultivators that the growing of beet roots improves the soil and that the residue of the fabrication furnishes an excellent food for cattle.

On March 25, 1811, Napoleon issued a decree appropriating 1,000,000 francs (\$200,000) for the establishment of six technical beet-sugar schools, compelling the peasant farmers to plant 79,000 acres to sugar beets the following season, and decreed that "From the 1st of January, 1813 * * * the sugar and indigo of the two Indies shall be prohibited." (Extract from decree attached hereto.)

On January 12, 1812, Napoleon issued a decree providing that 100 students should be selected from the schools of medicine, pharmacy, and chemistry and transferred to the technical beet-sugar schools he had established the year before; that 150,000 acres should be sown to beets; that financial inducements be extended to scientists to further perfect the process of extraction and to capitalists to engage in the manufacture, and for the immediate erection of four imperial beet-sugar factories. (Copy of decree attached hereto.)

As a result of the perception, determination, and power of one man, the industry which was to revolutionize modern agricultural methods not only was created but within two years was established on an extensive scale, as is shown by the report of Napoleon's minister of the interior at the beginning of 1813, in which he said:

During this year the manufacture of sugar which is extracted from the beet root will give us 7,700,000 pounds of this staple. It is prepared in 334 factories, all of which are in actual activity. * * * Nothing has been neglected to naturalize this staple at home, and the conquest is finally assured.

For centuries Europe had been cursed with sagebrush, gravel-pit farming methods, such as our low crop yields demonstrate still are in vogue to a great extent in the United States to-day, and while Napoleon compelled the peasant farmers to grow beets whether they wished to or not, his scientists and their successors developed scientific agricultural methods, taught the French farmers how to cultivate beets and other crops properly, and as the beet sugar industry spread to other nations, their scientists and economists vied with the French in this work, until now, in most portions of Europe, everything is farmed properly, as is shown by their superior crop yields.

At the time sugar beets were introduced in France, European farmers were plowing but 3 to 4 inches deep, but the beet being a deep rooter, compelled them to adopt deep plowing—Cato's first principle of good agriculture—and as the benefits of it came to be recognized, deep plowing became the custom in the culture of all crops.

European economists observed that following beets the roots of cereal crops which theretofore had drawn nutriment from but 3 to 4 inches of soil now followed the interstices left by the millions of decaying beet rootlets which were broken off when the beets were dug, and by drawing nutriment from double the depth of soil they doubled their soil productivity without increasing their acreage.

European agriculturists found that the frequent hoeings necessary to the production of a beet crop rid their fields of noxious weeds, and thus the full strength of the soil went to the crops they were raising, instead of being drawn upon to maintain a growth which was worse than useless.

As a result of sugar-beet rotation in Europe it was observed that where formerly it had been necessary to allow the exhausted soils to lie fallow every fourth year in order to rest them and to tear out the thick growth of weeds, they now could secure a heavy crop each year.

Once inaugurated, the growing of sugar beets rapidly increased and soon became one of the most important industries in France, that country since having produced 27,000,000 metric tons of beet sugar.

During the time that France has been producing 27,000,000 tons of sugar for home consumption and for export, worth, at 4 cents per pound, \$2,364,000,000, our imports of sugar have risen from 50,000 to 2,500,000 tons a year, and during that period we have imported 67,000,000 tons of sugar at a cost to the Nation of \$4,600,000,000.

We raise and export the wheat from 6 acres of ground and use the proceeds to purchase sugar which we could raise at home on 1 acre. To-day it requires the gold we receive from all the wheat we produce on 11,000,000 acres to purchase abroad the sugar we could produce at home on less than 2,000,000 acres, and by so doing cease tilling 9,000,000 acres or use it for other purposes.

The sugar we import contains no fertilizing elements, while each bushel of wheat carries with it $17\frac{1}{2}$ cents worth of nitrogen, phosphoric acid, and potash, and the wheat we annually exchange for \$180,000,000 worth of sugar carries with it fertilizer to the value of \$30,000,000. In exporting 5,000,000,000 bushels of wheat since 1867, and exchanging it for sugar, we have robbed our soils of nearly \$1,000,000,000 worth of fertilizing elements.

France is the size of our three greatest wheat-producing States, Kansas, Minnesota, and North Dakota. In 1907 France sowed 16,000,000 to wheat, as did these three States. Since the introduction of beet culture, French soils have been so rejuvenated that from her 16,000,000 acres of wheat French farmers harvested 325,000,000 bushels, while from our 16,000,000 acres the farmers of Kansas, Minnesota, and North Dakota harvested but 188,000,000 bushels, or 11.7 bushels to the acre to the Frenchman's 20.3 bushels.

From France the beet-sugar industry spread to every country of continental Europe, which since has produced 150,000,000 metric tons of sugar, worth, at 4 cents per pound, \$13,000,000,000.

Europe produces annually 8,000,000 tons of beet sugar, consumes 5,500,000 tons, and exports 2,500,000 tons, while the United States produces 800,000 tons of beet and cane sugar, consumes 3,300,000 tons, and imports 2,500,000, taking a portion of Europe's exports.

Not only does Germany produce the sugar her people consume and \$50,000,000 worth for export, but by reason of better farming methods, brought about through the establishment of the beet-sugar industry, her so-called "worn-out soils" now produce 30.5 bushels of wheat to our 15.8; 59.1 bushels of oats to our 30.3; 39.4 bushels of barley to our 24.3; 29.4 bushels of rye to our 16.1; and 208.9 bushels of potatoes to our 106.8.

In 1907, Germany and Kansas each sowed 5,200,000 acres to wheat and from their 5,200,000 acres of rejuvenated soil, German farmers reaped 145,000,000 bushels, while from our 5,200,000 acres of virgin soil, Kansas farmers reaped but 68,000,000 bushels.

Germany alone absorbs one-half of the world's production of potash and the European imports of commercial fertilizer are enormous. As commercial fertilizers aid the chemical condition of the soil, so sugar beets aid its physical condition. When the farmers apply commercial fertilizers, they have to pay for the fertilizer, but when, by growing a crop of beets which they sell for enough to pay for the cost of production, and at the same time add greatly to the productivity of the soil, it is equivalent to securing the fertilizer for nothing.

As compared to the total United States production, Germany, with an area equal only to that of Minnesota, Iowa, and Missouri, produces one-tenth as much tobacco, one-fifth as much wheat, three-fifths as much oats, four-fifths as much hops, four-fifths as much barley, three times as much sugar, six times as many potatoes, and nine times as much rye. In 1907, German farmers, from 43,000,000 acres sowed to wheat, rye, barley, oats, and potatoes, harvested 3,000,000,000 bushels, while from the 88,500,000 acres sowed to the same crops in the United States, American farmers harvested but 1,875,000,000 bushels. In other words, from less than one-half our area, German farmers harvested nearly double the number of bushels.

If on land devoted to wheat, oats, barley, rye, and potatoes in Germany their farmers secured only our average acreage yield of those crops, German farmers would be poorer by \$900,000,000 a year.

If on the land we devote to wheat, oats, barley, rye, and potatoes American farmers secured the same yield per acre as is secured by German farmers, our farmers would be richer by \$1,400,000,000 a year.

By the expenditure of far more labor the German farmer secures a yield of beets 2 to 3 tons per acre in excess of our average yield, but

the money value of the German's larger crop is less per acre than is the smaller yield of the American farmer, yet German farmers produce 15,000,000 tons of beets annually, while American farmers produce but 3,500,000 tons. On the other hand, German farmers produce 30.5 bushels of wheat per acre to our 15.8 bushels and the price per bushel is higher in Germany than it is in the United States. Notwithstanding these facts we export \$119,000,000 worth of wheat and wheat flour and import \$180,000,000 worth of sugar, while Germany exports \$50,000,000 worth of sugar and imports \$65,000,000 worth of wheat. Considering the fact that there is no crop grown the yield of which is increased by preceding it with a wheat crop and that there is no crop grown the yield of which is not increased by preceding it with a beet crop, are the Germans wise in importing wheat and exporting sugar, or are we wise in importing sugar and exporting wheat?

When we import 95° or 96° sugar, we are importing a product on which practically all of the labor has been performed in a foreign country. To melt and recrystallize this sugar and prepare it for the table contributes but little to American industry. In refining the 3,148,818 short tons of raw sugar we imported and consumed last year there accrued to American industry in office expenses, brokerage, labor, fuel, bone black, bags, barrels, and all other supplies \$6.48 per ton, or \$20,404,340, while in producing but 511,840 tons of refined sugar from American-grown beets there accrued to American industry \$38,388,000, on the basis of 3.75 cents per pound average cost. To import all our sugar and merely refine it in this country would contribute but \$22,842,000 to American industry, while to produce the same amount of sugar from American-grown beets would contribute \$274,547,000 to American industry.

That we have an abundance of sugar-beet land on which to produce our sugar is shown by a report of the Secretary of Agriculture, in which he states that if but 1 acre in 50 of our well-defined sugar-beet area were planted to sugar beets once every four years it would produce all the sugar we now purchase from foreign countries, and thus would return our farmers \$125,000,000 a year instead of \$21,000,000, as at present.

We are said to "feed the world," but with only 45 per cent of the surface area of the United States, Europe, without Russia, produces twice as much wheat and oats, three and one-half times as much barley, seven times as much sugar, twelve times as many potatoes, and twenty-five times as much rye as is produced in the United States, notwithstanding the fact that we lie in the same latitude, have a superior agricultural climate, virgin soils of greater natural richness, and that her soils have been cropped for centuries.

While the United States often is represented as "feeding the starving hordes of Europe," the truth is that their rehabilitated soils, even excluding Russia, the "granary of Europe," produce more bushels of the five crops of wheat, rye, barley, oats, and potatoes per capita of their population than we produce in the United States per capita of our population.

As compared to Europe, we have richer soils, a better agricultural climate, more live stock to produce the fertilizer, more and better farm implements and machinery, a more extensive, scientific, and expensive Department of Agriculture, presided over for the last 14

years by the greatest executive agriculturist we have produced, a more intelligent and well-to-do class of farmers, and yet, with all these superior conditions, our combined average acreage yields of wheat, rye, barley, oats, and potatoes in 1907 were but 21.2 bushels per acre, as compared to an average yield of 43 bushels for the same crops throughout the Continent of Europe, exclusive of Russia.

Our increased use of commercial fertilizers from \$45,000,000 valuation in 1890 to \$110,000,000 in 1910 would seem to be inadequately reflected in our 8 per cent increase in combined average acreage yield of wheat, rye, barley, oats, and potatoes during the past 30 years, especially when compared to the 75 per cent increase in acreage yield of the same crops in Germany during the same period, as shown by the following official figures of the two countries:

Increase in yield of five staple crops in Germany and the United States.

	Germany.		United States.		Increase.			
	1878-1883	1909	1879	1909	Germany.	United States.	Germany.	United States.
	<i>Bushels per acre.</i>	<i>Bushels per acre.</i>	<i>Bushels per acre.</i>	<i>Bushels per acre.</i>	<i>Bushels.</i>	<i>Bushels.</i>	<i>Per cent.</i>	<i>Per cent.</i>
Rye.....	15.7	29.4	14.5	16.1	13.7	1.6	87.2	10.9
Wheat.....	19.2	30.5	13.8	15.8	11.3	2.0	58.8	14.2
Barley.....	24.5	39.4	24.0	24.3	14.9	.3	60.8	1.2
Oats.....	31.8	59.1	28.7	30.3	27.7	1.6	85.8	6.7
Potatoes.....	115.5	208.9	98.9	106.8	93.4	7.6	80.8	7.6

As all the preceding statements concerning the acreage yields and production in Europe and the United States are based on official figures which readily can be verified, they should correct the all but universal misconception concerning this important subject, humiliating though the truth may be.

Conceding the fact, which can be substantiated by the written words of Europe's foremost thinkers of the past century, that the beet-sugar industry more than any one or all other causes combined has furnished the inspiration which has resulted in placing Europe so far in advance of the United States in concrete agricultural results, the question naturally arises as to why we have not followed more closely in Europe's footsteps, doubled the acreage yield of our staple crops, and produced all of our sugar at home, instead of producing but 500,000 tons of beet sugar at home and importing 2,500,000 tons, the equivalent of what Europe exports after supplying her 400,000,000 inhabitants.

Of minor causes, there are several, including the¹low wage rate of Europe,²the lower price for beets,³the fostering care of their governments, extending even to the placing of large bounties on sugar exports in order that they might compete successfully with tropical sugars, while our fiscal system has been unstable and vacillating, sometimes affording protection to home producers and sometimes not. Since the time France prohibited the importation of sugar and established the beet-sugar industry in that nation, the United States customs duty on imported sugar has undergone thirteen revisions, being reduced from time to time by various Congresses from 10 cents per pound to absolute free trade, and now is fixed at 1.65 cents for 95° and 1.9 cents for refined sugar.

The main reason why we produce but one-half to two-thirds as many bushels of grain per acre as does Europe is because, with rare exceptions, our American economists have failed utterly to recognize the beet-sugar industry as the father of modern scientific agriculture, the very fountain head of inspiration from which the science sprang, the great "normal school" of agriculture which trains the indifferent farmer to be an expert farmer, because of the fact that sugar beets form the only important agricultural crop which, unless the price per ton be exceedingly high, refuses to return a profit or even expenses when farmed in a slipshod manner, and the superior methods which the farmer is forced to apply to beet culture gradually are applied to the production of other crops and finally are adopted by neighboring farmers, even though they raise no beets.

It was beet culture that forced European farmers back to deep plowing, compelled them to clear their fields of weeds, caused them to adopt a scientific system of crop rotation, led them to devise new and better implements, doubled their stock-carrying capacity as well as their manure, and brought them to a better realization of the value of barnyard manure, as well as of commercial fertilizers, and as a result what were formerly the "worn-out soils of Europe" now are so productive as to make our "virgin soils" seem barren in comparison.

While American economists have failed to recognize the sugar beet as the father of modern scientific agriculture, there are some few who realize the great indirect advantages to be derived from the culture of beets, but even they have failed to capitalize and put in concrete form these indirect benefits in order that our people might realize the enormous wealth which would accrue to the Nation by deriving our sugar supply from home-grown beets. As in teaching the farmers the stress has been laid upon "so many tons of beets per acre at so much per ton," so in teaching the people the main stress has been laid upon keeping a hundred or two millions at home each year by producing our sugar at home instead of importing it, almost universally overlooking the far more important and valuable indirect benefits.

Having failed to impress the farmers with the rotation value of sugar beets and the enemies of the industry having spread broadcast the erroneous statement that sugar-beet culture injures the soil—just as in the inception of the industry an English society offered Achard first \$30,000 and then \$120,000 if he would declare his process a failure, and finally induced Sir Humphrey Davy to publish a work on beet sugar in which he declared it was far too sour for consumption—the average American farmer has been slow to engage in beet culture, even at prices for his product ranging from 25 to 80 per cent in excess of the prices paid for richer beets in Europe. In establishing 334 beet-sugar factories in as many localities in France in 2 years, Napoleon opened 334 schools of scientific agriculture, while in the 33 years since the establishment of our first successful beet-sugar factory we have created but 66 such schools, concerning which the present Secretary of Agriculture says:

Every sugar-factory management in this country must necessarily call to its aid a thoroughly scientific and practical agriculturist, and under him a corps of assistants, equipped and conversant, not only with cultivating sugar beets, but familiar with methods of culture, fertilization, drainage, rotation, and all the necessary scientific knowledge to produce successfully all kinds of crops indigenous to the particular

locality. This agriculturist and his assistants are constantly traveling over the sugar-beet producing district of this particular factory, advising farmers particularly in the growth of beets, and generally in the production of all other crops. They are as much interested incidentally in the handling of the lands producing other crops as they are particularly the one in charge. It is these other lands that will produce sugar beets next year.

A sugar-factory district is an "extension course" in agriculture to every farmer in the district, whether he be growing beets or not. It could not be conceived, with such influences constantly in operation, that the sugar industry is not exerting a potent influence most favorable in production of all crops.

If the above-mentioned truths, no truer to-day than they have been at any time during the past century, had been drilled into the head of every farmer boy at the little red schoolhouse, as they are and have been in Europe since the time of Napoleon, we long since would have been producing our own sugar at home and, because of our superior soil, climate, and numerous other advantages, our acreage yields of all other crops to-day would be the envy instead of the ridicule of European thinkers. As it is, we have missed the mark completely. As a rule, our farmers have taken the shadow for the substance. "So many tons of beets per acre at so much per ton" is the first thing considered in America and the last thing in Europe, and if sugar beets failed to yield a greater direct profit than do other crops, the average American farmer abandons the culture and applies himself to growing the more easily produced cereals, while the European farmer will grow beets at a considerable direct loss rather than to abandon the culture, well knowing that he will far more than make up any losses on the beet crop by the increased yields of other crops with which, for three years, he follows beets. It unquestionably is true that, because of the exceedingly low world price of sugar, Europe long ago would have ceased to produce sugar for export, if not for home consumption, had it not been that beet culture so greatly increases the yield of all other crops.

Instead of growing beets on the same soil year after year, the European farmer rotates them with other crops, sowing them on the same soil as infrequently as possible, in order to benefit the maximum area, never losing sight of or sacrificing the advantages to accrue for the following three years, while tens of thousands of American farmers, sowing beets only for the direct returns, sow them on the same soil year after year, thereby not only losing the greatest profit beet culture affords, but gradually wearing out their soils as they surely will be worn out by cropping them constantly to any one thing year after year without rotation.

In every community where sugar beets are produced, there are farmers who, by personal experience, have learned the truths which Napoleon proclaimed a century ago, and their number is increasing yearly, but there are thousands who still miss the main feature in the culture of sugar beets as thoroughly as one would miss it who said that a farmer painted his barn red in order to provide a red building to gaze at. With the European farmer the main purpose in planting sugar beets is to increase the yield of his other crops by rotation with the beets, just as the primary purpose of painting a barn red or yellow is to preserve the wood. With the European farmer, the direct returns from a crop of beets are as truly an incident as is the color of the barn.

The following limited selection of letters and reports received from farmers located in beet districts from Ohio on the east to Washington

on the west is sufficient to show that with the spread of the beet-sugar industry and the consequent adoption of proper cultural methods, the farmers of the United States can render their soils even more productive than are the rejuvenated soils of Europe, and that the beneficial results to be secured from the introduction of this crop are not confined to restricted localities.

While corresponding closely with other reports on file, the number of reports herewith produced is too small to be used as a basis for an accurate calculation, but that the results obtained by these farmers approximate the results that are obtained by other equally intelligent farmers and which would be obtained by them generally with the further expansion of the beet-sugar industry, there is no reason to doubt.

The average of these 30 reports shows that at the time these farmers introduced beet culture, their yield of wheat was 92 per cent above the United States average yield for 1907, their yield of barley was 37 per cent higher, and their yield of oats was 70 per cent higher than the United States average. Notwithstanding this fact, by the introduction of beet culture as a rotating crop, they increased their acreage yield of wheat 42.5 per cent, their barley 78.6 per cent, and their oats 71.8 per cent. If, through the general introduction of beet culture, all of our farmers should increase their yields of wheat, barley, and oats a like number of bushels per acre, based on 1909 farm prices, they would be richer by a billion and a quarter dollars a year, and if they brought their yields up to those now secured by these farmers, their extra yield of these three crops, on the same acreage, would be worth \$2,000,000,000 a year.

The average acreage yield of sugar beets secured by these farmers was 14½ tons per acre. One report on alfalfa shows an increase of 1 ton and another of 2 tons per acre, while one report on beans shows an increase of 5 bushels per acre and another 6 bushels. One report on potatoes shows an increase from a merely nominal yield, to 200 sacks, or nearly three times the average United States yield. Whether with the general introduction of sugar-beet culture, the acreage yields of all our farmers would be increased as much, or more or less, can not be determined. That they could do it, there is no question, but that some still would farm in a shiftless manner, is altogether probable.

Averages of the following reports:

Average acreage yield of wheat, barley, and oats, prior and subsequent to the introduction of sugar beets as a rotating crop.

	Wheat.	Barley.	Oats.
Average United States yield per acre, 1907..... bushels..	15.8	24.3	30.3
Average German yield per acre, 1907..... do.....	30.5	39.4	59.1
Excess German yield per acre, 1907..... do.....	14.7	15.1	28.8
Excess German yield per acre, 1907..... per cent..	93.0	62.0	95.0
Average yield per acre prior to sugar-beet culture, as shown by following reports of American farmers..... bushels..	26.9	32.7	40.2
Average yield per acre by same after introducing sugar beets as a rotating crop..... bushels..	43.6	58.4	69.1
Excess yield per acre caused by rotating with sugar beets..... do.....	16.7	25.7	28.9
Increase in yield per acre..... per cent..	42.5	78.6	71.8
Yield per acre in excess of United States 1907 average yield..... bushels..	27.8	34.1	38.8
Excess of United States 1907 average yield..... per cent..	176.0	140.0	127.0
Yield per acre in excess of German 1907 average yield..... bushels..	13.1	19.0	10.0
Excess of German 1907 average yield..... per cent..	43.0	48.0	16.0

REPORTS FROM AMERICAN SUGAR-BEET GROWERS, SHOWING INCREASED YIELD OF OTHER CROPS BY REASON OF BEING ROTATED WITH SUGAR BEETS.

OHIO.

We are well satisfied in raising other crops where we had beets before. We always raise better crops on our beet ground than on our other ground. We have had sugar beets four years and always find satisfaction. We started with 3 acres and this year 12 acres. We raised wheat, oats, barley, and corn. (Tony Bast, Graytown, R. F. D., 17.)

We are now raising our sixth consecutive crop of sugar beets. When we planted the first seed we were told that the beets would wear out the soil; that the sugar company were swindlers and would compel the farmers to pit the beets till winter; that if the beets were frostbitten they would be worthless. We have yearly realized from \$50 to \$75 per acre for the beets and, moreover, with experience we are ready to state that we always grow one-third more oats or barley on ground where beets were raised the previous year than on ground that has raised no beets. (Jos. Shiple & Sons, Perrysburg.)

MICHIGAN.

I wish to say that I have grown sugar beets for the last three years and I can truthfully say that the growing of sugar beets is a benefit to the soil if the crop is given proper rotation. I have received the best results by following the crop with a crop of oats. This season (1909) I thrashed from 5 acres of measured ground, which was in sugar beets last season, 270 bushels of oats, or an average of 54 bushels per acre. The balance of my oat crop which was on ground following a corn crop (equally as good soil) is yielding about 40 bushels per acre. Therefore I feel that I am justified in making this statement. (Alex. Larkins, Carleton.)

I have raised beets for the last seven years and have averaged about 16 tons per acre. I also find that oats will do better on the ground where I raise beets than they will on other ground. This year the oats on my beet ground produced 75 bushels per acre, while the others only produced about 60 bushels per acre. (Sam Seizert, Blissfield.)

In regard to beet culture, I wish to say that I have raised sugar beets for six years and consider it one of the most profitable crops that a farmer can raise. Not only because he gets the greater return for his labor, when they are properly cared for, but because the ground is left in the best possible condition for the next crop, for since raising sugar beets my land has been gradually increasing her yield per acre. The increase in yield of oats has been from 15 to 25 per cent, or from 40 or 45 to 55 bushels per acre, and on wheat the increase has been about the same. When I have raised beets two consecutive years on the same piece of ground and then sowed oats they were extra. We as farmers are satisfied that we get better crops since raising beets. (S. S. Teed, Middleton.)

In regard to the condition of ground that beets have been grown on, will say that I have grown beets quite extensively and find that it is an improvement rather than a detriment to the soil. In 1901 I grew 2 acres of beets; went about 18 tons per acre; followed with beets, besides adding 29 acres, making 31 acres for 1902, average yield, about 11½ tons. Out of 31 acres, 17 acres to beans following, yielding 14 bushels per acre. Same 12 acres to wheat yielding 37 bushels per acre, following with the biggest crop of hay ever cut in the neighborhood, and 5 acres of 17-acre bean ground went to oats the following spring, yielding 53 bushels besides one-third loss on account of being lodged, average for year in neighborhood being about 27 bushels. In 1904 had 2½ acres of beets, yielding about 9 tons, following with oats yielding 45 bushels per acre; average in neighborhood, about 30 bushels per acre. In 1905 had 40 acres of beets, 8 tons; following 8 acres to beets again, yielding about 10 tons second year; following next with oats yielding 51 bushels per acre. Balance of 40 acres, 12 acres went to beans; balance of 20 acres were sown to oats, yielding about 47 bushels per acre; following same with wheat, yielding about 28 bushels, when average in neighborhood was about 13 bushels. In 1906, had 14 acres to beets, about 10 tons yield, following same with 14 acres to oats, yielding about 47 bushels per acre; then to wheat, yielding 28 bushels per acre; average for wheat that year in neighborhood about 13 bushels per acre. In 1907 had 17 acres in beets, average about 11 tons. Of 17 acres 3 acres went to oats, and seeded 6 acres to beets again, yielding about the same, and balance of 17 acres, or 8 acres, went to oats, yielding 48 bushels per acre; then to wheat, yielding this year 38 bushels per acre, and good seedling in wheat. In 1908 had 15 acres of beets, about 10 tons average yield; 12 acres now to oats with a yield of 44

a bumper crop, and balance of 15 acres, or 3 acres, are to beets again this year. This year have 26 acres to beets with good prospect for 11 or 12 tons. This report was made and kept on one of my "eighties." On the other have grown in the last four seasons, including 13 acres this year, 71 acres, with about the same results in regard to following crops, although have no record of different fields and yield. (W. J. Davis, Sunfield.)

It gives me great pleasure in having a chance to show to my brother farmers the little I know about sugar beets placing the soil in a better mechanical condition for other grain crops than any other crop in the rotation. On a 6-acre lot of beets I harvested 11 tons per acre of beets. I followed the beets with barley and got 50 bushels per acre; an increase of 50 per cent as compared with crops raised by my neighbors and myself formerly. The above 6 acres was put to wheat after the barley and made 35 bushels per acre, and the stand of clover is good for sore eyes. I am more than satisfied with the beets, not alone for the money crop, but also the permanent good to the land. (W. L. Huber, Charlotte.)

WISCONSIN.

J. L. Walsh, of Beloit, reports that with a farm of which 400 acres are under cultivation, the principal crops being cabbage, sugar beets, oats, onions, and clover, has grown sugar beets for five years and has 75 acres of beets which, under normal conditions, yield 18 tons per acre. Follows a four-year rotation, including cabbages two years; beets one year, oats and clover. Follows sugar beets with grain and clover, then cabbages. Plows 7 inches deep, and disks and harrows until seed bed is perfect. Uses barnyard manure and commercial fertilizer. Hoes his beets twice and cultivates with a horse seven or eight times. Raised 46 bushels of oats to the acre on a 37-acre field, which the following year was put to beets, and the following year harvested 107 bushels of oats to the acre, while his yield from a 7-acre field of potatoes which before produced between 75 and 90 bushels, after beets increased to 225 bushels. He says: "I grew 150 acres of beets in 1907, and in 1908 the same land and 100 additional acres to beets on the same farm. In 1909 the whole was sown to oats and produced 87 bushels per acre."

In reply to your letter concerning the number of bushels of grain raised on sugar-beet ground, will say that from 11 acres of sugar-beet ground I raised 783 bushels of oats this year (71 bushels per acre), and that was all the oats I had sowed this year. The other farms joining mine only had a yield of between 30 to 40 bushels. Mr. Stieneke, one of my neighbors, raised over 75 bushels of oats to the acre on sugar-beet land. (Dell Tuttle, Ripon.)

For the past seven years I have had from 2 acres to 30 acres of beets—sugar beets—on this farm. I always have found sugar-beet land the best for small grain, oats and barley and clover and timothy, of any land; much better than corn land. I find a crop of sugar beets well cared for, pays as good as any crop at high prices, and the best crop to clear the land of all foul weeds, including quack and Canada thistle. On a 15-acre lot where sugar beets were raised last year, 1908, I thrashed and sold 600 bushels of barley (40 bushels per acre) which graded 47 pounds per bushel. Thirty bushels barley per acre is a good crop here. On an 18-acre lot where 11 acres sugar beets and 6 acres cucumbers and 1 acre corn were raised last year, 1908, I thrashed 1,000 bushels oats. On the cucumber land the oats were weedy, rusty, and lodged very green, which made a good 60 bushels of oats per acre on the sugar-beet land. Forty to 50 bushels of oats per acre is a good crop here. (R. M. Sherwood, Ripon.)

IOWA.

In 1908 I grew 3 acres of sugar beets for the Iowa Sugar Co., receiving 12 tons per acre. In 1909 I planted the same ground to corn. Adjoining the 3 acres of beets I broke up some new land and planted it to corn. During the growing season the corn on the new land stood taller than the corn on the beet ground. When I husked the corn this fall, the yield from the beet ground was 70 bushels per acre, and the yield from the new ground was 60 bushels per acre. In my estimation, beets do not hurt the ground, but improve it for the next crop. (C. Grimm, Cresco.)

Followed beets with oats, 1909, 20-acre field. Field seeded to clover and hay taken off the year before the beets. Beets went from 12 to 13 tons per acre. Oats thrashed out 65 bushels per acre and weighed out 70 bushels per acre, average for 20 acres, the champion yield in Iowa for 1909. (Leonard Miller, Waverly.)

E. H. Mallory, of Hampton, has a 200-acre farm and has 44 acres in beets, which have increased his yield of corn from 50 bushels to 60 bushels, and oats averaging from 20 to 30 bushels have increased to 50 bushels.

KANSAS.

A. R. Downing, of Deerfield, reports a field of alfalfa plowed up several years ago and put to wheat, yielding 45 bushels per acre. The field was then planted to beets three years in succession and was then followed by oats, yielding 73 bushels per acre. The oats were followed by wheat, which gave a yield of 53 bushels per acre.

Mr. Carl Coerber, of Deerfield, plowed up a field of alfalfa and put it in wheat, which gave an average yield of 35 bushels per acre. This was followed by beets for two years, then oats one year, and wheat following the oats gave a yield of 45 bushels per acre.

NEBRASKA.

James R. White, of Hershey, route 1, reports that he farms 210 acres. Principal crops alfalfa, beets, corn, and oats. Has grown sugar beets for five years. Has 15 acres in beets, which usually yield 14 tons to the acre. Plows 9 to 10 inches deep. Harrows four times. Fertilizes with barnyard manure. Hoes twice and cultivates six times. A 15-acre field of oats prior to beet culture yielded 35 bushels to the acre; after being in beets two years, yielded 50 bushels to the acre. A 30-acre field of alfalfa, which yielded 4 tons to the acre prior to beet culture, yielded 6 tons to the acre after having been planted to beets three years.

S. E. Solomon, of Culbertson, reports that he has a 1,000-acre sandy-loam farm; with 800 acres under cultivation to wheat, corn, potatoes, sugar beets, and alfalfa. Has 300 acres in sugar beets; has grown beets for eight years, and averages 10 tons per acre. He says: "Never practiced system of rotation; am not following a system, but should do so. Depth of plowing, 6 inches; should be 12; use no fertilizer. Am not employing any system of fertilization or rotation. Hand hoe beets one or two times; horse cultivate two or three times. Am positive that rotation and fertilization would double average yields. The most slipshod methods are employed in growing beets in this section. What is needed is deep plowing, careful rotation, and use of barnyard manures. Have had enough experience to fully demonstrate this." [Frank, but foolish.]

COLORADO.

Lee Kelim, of Loveland, a large landowner, formerly the owner of the Loveland mill, and who has operated thrashing machines in that vicinity for 25 years, says that previous to the starting of beet growing, 20 to 25 bushels of wheat was considered a large crop, and that out of this they would screen 15 to 20 pounds of wild oats. Now 40 to 50 bushels is considered an average crop, and he feels safe in saying that in the Loveland district the introduction of beets into the crop rotation has increased the yield of grain 100 per cent, and has cleaned the country of the wild oats pest.

J. L. Sybrandt, of Berthoud, reports that he has a 360-acre farm, of which 290 acres are under cultivation to wheat, oats, alfalfa, barley, potatoes, and 68 acres to sugar beets, which average 12 tons per acre and which he rotates with other crops every three to five years, and fertilizes his ground with sheep manure. He has grown beets for four years and has increased his wheat yield of 20 to 30 bushels to 56 bushels per acre, and his barley yield from 30 to 40 bushels to 65 bushels per acre.

David Snider, of Platteville, reports that he has a 2,000-acre farm, of which he cultivates 1,200 acres to alfalfa, wheat, oats, barley, potatoes, and sugar beets, of which he had in 400 acres. Has grown sugar beets for six years, secured a yield of 13½ to 18 tons per acre and rotates them with other crops, following them with wheat or barley. Plows his land 10 inches deep. Has increased his wheat yield from 30 to 35 bushels to 35 to 50 bushels per acre; his oats from 20 to 25 bushels to 60 to 75 bushels; his barley from 25 to 30 bushels to 70 to 85 bushels; and his potatoes from a nominal yield to 200 sacks per acre.

The Taylor-Fuller Mercantile Co., of Avondale, report that they have been farming for 14 years, operating a 120-acre farm, of which 100 acres are in cultivation. They have grown sugar beets for eight years and average 14 tons to the acre, rotating beets with other crops. By rotating with beets they have increased their wheat yield from 25 to 40 bushels per acre; oats from 30 to 50 bushels; beans from 12 to 18 bushels; and hay from 3 to 4 tons per acre. They say: "Before the introduction of sugar-beet raising farming was conducted in a very loose way, and as it is impossible to raise sugar beets at a profit without employing the best farming methods, it has made better farmers, and they have found the same pay with any crop. For some reason grain and in fact all other crops do well following beets, although the land may be worn out for sugar beets." [NOTE.—In this section it has been customary to follow the "gravel-pit" method of farming, and grow beets on the same soil year after year without rotation; with the inevitable result that the land finally refuses to produce a paying crop of

beets until it has been rested from this crop. As well try to eat a quail every day for a month as to try to farm in this manner. In both cases, nature rebels.]

J. Reimer, of Pueblo, reports that he has been farming in that section 14 years and has 50 acres in cultivation, of which 13 acres are in beets. Has grown beets 5 years and averages 14 tons per acre. Plows 10 inches deep, harrows four times, hand hoes three times, horse cultivates four times, fertilizes with stable manure. Rotation with sugar beets has increased his corn yield from 20 to 30 bushels per acre; oats from 40 to 65 bushels; rye, no increase from 40 bushels; beans from 15 to 20 bushels; and no increase in his alfalfa crop of 5 tons per acre.

MONTANA.

John B. Clewett, of Fromberg, reports that he is operating a 425-acre farm, with 150 acres under cultivation, 60 being to beets; secured yield of 15 tons of beets per acre. A tract of 22 acres which yielded 27 bushels of wheat per acre prior to beet culture was put into beets for three consecutive years, when it yielded 45 bushels of wheat per acre. His oat crop increased from 60 bushels to 80 bushels under like conditions. He says: "Beet cultivation is a good thing for the character of soil in this district, as it seems to fertilize and increase the production of grain two or three seasons after rotation."

UTAH.

W. T. Wymont, Warren, Weber County, reports 10 acres to beets. Previous to raising beets this land produced 25 bushels of wheat to the acre. Beets were grown on the land for three years, after which it was planted in wheat again, producing 45 bushels to the acre, an increase of 20 bushels to the acre.

J. F. Stoddard, Hooper, Weber County, reports 5 acres to beets. Previous to growing beets the land produced 35 bushels of barley to the acre. Beets were grown on this land for four successive years, after which the land was planted to barley again and produced 55 bushels to the acre, an increase of 20 bushels to the acre.

Thomas Jones, Hooper, Weber County, reports 10 acres to beets. Previous to planting of beets, this land produced 20 bushels of wheat to the acre. After growing beets for three successive years it was again planted in wheat and produced 35 bushels to the acre, an increase of 15 bushels per acre.

IDAHO.

George A. Pincock, of Sugar City, reports that he has grown sugar beets for five years and has 50 acres in beets, averaging 15 tons per acre. Prior to beet culture, his wheat yielded 25 to 30 bushels; following beets, 50 to 60 bushels. Oats, prior to beets, 40 to 46 bushels; following beets, 75 to 100 bushels. Barley, prior to beets, 40 to 60 bushels; following beets, 75 to 100 bushels. He says: "I see these yields prevailing wherever beets have been raised."

WASHINGTON.

James Hays, of Waverly, reports a yield of 80 bushels of oats after spring plowing, and 100 bushels following beets; of wheat, after spring plowing, 40 bushels, and 50 bushels after beets, this being the average during a period of several years.

F. Kienbaum, of Waverly, reports his oat yield at 60 bushels after spring plowing, and 90 bushels on beet land; wheat, 30 bushels after spring plowing, and 50 bushels on beet land.

A. D. Thayer, of Waverly, reports yield of 45 bushels of oats after spring plowing, and 100 bushels on his beet land; wheat, 35 bushels after summer fallow, and 45 bushels after beets.

William Connolly, of Waverly, reports yield of 75 bushels of oats after spring plowing, and 85 to 95 bushels after beets; wheat, 40 bushels after summer fallow, and 50 bushels following beets.

CALIFORNIA.

D. J. Murphy, of Chico, superintendent of the heirs of James Phelan, operating an 8,000-acre farm with 3,000 acres under cultivation, has grown sugar beets for five years and has 600 acres to beets. Secures yield of 12 to 20 tons and practices a rotation system consisting of wheat, followed by barley, then pasture of voluntary wheat or barley, followed by sugar beets. Plows 12 inches deep. Reports an increase in yield of wheat, due to sugar-beet rotation, from 10 to 12 bags of 133 pounds each (23 to 27½ bushels) to 15 bags of 140 pounds each (35 bushels); of barley, from 16 bags of 108 pounds each (36 bushels) to 24 bags of 108 pounds each (54 bushels).

First Decree of Napoleon Bonaparte on the Manufacture of the Beet-root Sugar.

Paris, 15th Brumaire Year 10.

Napoleon Bonaparte, to all whom these presents shall come.

Whereas it is a business of importance to promote the means of raising the price of sugar, and the cultivation of the sugar beet, and to the value of the produce of the same;

Whereas it is a business of importance to promote the means of raising the price of sugar, and the cultivation of the sugar beet, and to the value of the produce of the same;

Whereas it is a business of importance to promote the means of raising the price of sugar, and the cultivation of the sugar beet, and to the value of the produce of the same;

Whereas it is a business of importance to promote the means of raising the price of sugar, and the cultivation of the sugar beet, and to the value of the produce of the same;

We have decreed, and do hereby decree as follows:

ARTICLE 1. The number of houses for the manufacture of sugar shall be limited in our Empire to the extent of 20,000 houses.

ART. 2. Our minister of the interior shall, on the 1st of May, 1812, determine among the Departments of our Empire, taking into consideration the Departments where the culture of beets may be established, and those which shall be the most fertile in the soil, may be most favorable to the culture of the beet root.

ART. 3. Our present shall take measure that the number of houses allowed in their respective Departments shall be in the proportion of a year to next year at the least.

ART. 4. A certain number of houses shall be left in our Empire to those who of want paper in the manufacture of sugar in the proportion necessary for our manufacturing.

ART. 5. Our minister of the interior shall determine the said number among the Departments beyond the Alps and those in the south where the beet root is raised in the most fertile soil.

ART. 6. Our present shall take measure that the number of houses allowed in their Departments shall be in the proportion of a year to next year at the least.

ART. 7. The commission shall have the 1st of May, 1812, to erect the most convenient places for the establishment of six experimental schools for giving instruction in the manufacture of beet root sugar, and to the process of fermentation.

ART. 8. The commission shall also have the same day to erect the most convenient places for the establishment of six experimental schools for giving instruction upon the extraction of sugar from the beets or wood according to the processes approved by the commission.

ART. 9. Our minister of the interior shall make known to the works in what places these schools shall be formed and to which points devoted to this manufacture should be sent. Proprietors and farmers who may wish to attend a course of lectures in the said experimental schools shall be admitted thereon.

ART. 10. Messrs. Barruel and Isenard, who have brought to perfection the process for extracting sugar from the beet root, shall be specially charged with the direction of two of the six experimental schools.

ART. 11. Our minister of the interior shall, in consequence, cause to be paid the sum necessary for the formation of the said establishments, which shall be charged to the fund of 1,000,000 francs (\$200,000) in the budget of 1812 at the disposal of the said minister for the encouragement of beet root sugar and wood indigo.

ART. 12. From the 1st of January, 1813, and upon a report to be made to our minister of the interior, the sugar and indigo of the two Indies shall be prohibited and considered as merchandise of English manufacture or possessing non-English commerce.

ART. 13. Our minister of the interior is charged with the execution of the present decree.

DECREE OF NAPOLEON, JANUARY 15, 1812.

SECTION 1.—School for manufacture of beet-root sugar.

ARTICLE 1. The factory of Messrs. Barruel & Chappolet, plain of Vertus, and those established at Wachenheim, Department of Mont-Tonnere, at Douai, Strasbourg, and at Castelnaudary are established as special schools for the manufacture of beet root sugar.

ART. 2. One hundred students shall be attached to these schools, viz, 40 at that of Messrs. Barruel & Chappelet, and 15 at each of those at Wachenheim, Douai, Strasbourg, and Castelnaudary; total, 100.

ART. 3. These students shall be selected from among students in medicine, pharmacy, and chemistry.

SECTION II.—*Culture of beets.*

ART. 4. Our minister of the interior shall take measure to cause to be sown throughout our Empire 100,000 metrical arpents (150,000 acres) of beets. The conditions of the distribution of the culture shall be printed and sent to the prefects previous to February 15.

SECTION III.—*Manufacture.*

ART. 5. There shall be accorded throughout our entire Empire 500 licenses for the manufacture of beet-root sugar.

ART. 6. These licenses shall be accorded of preference—

To all proprietors of factories or refineries.

To all who have manufactured sugar during 1811.

To all who have made preparations and expenditures for the establishment of factories for work in 1812.

ART. 7. Of these licenses shall be accorded of right, one to each Department.

ART. 8. Prefects shall write to all proprietors of refineries, in order that they may make their submissions for the establishment of the said factories at the close of 1812. In default on the part of proprietors of refineries to have made their submissions prior to March 15, or at the latest April 15, they shall be considered as having renounced the preference accorded them.

ART. 9. Licenses shall include an obligation on the part of those who shall obtain them to establish a factory capable of producing at least 10,000 kilograms (22,000 pounds) of raw sugar in 1812–13.

ART. 10. Each individual who, having secured a license, shall have actually manufactured nearly 10,000 kilograms of raw sugar resulting from the crop of 1812 to 1813; shall have the privilege and assurance, by way of encouragement, of being subject to no tax, or octroi, upon the product of his manufacture for the space of four years.

ART. 11. Each individual who shall perfect the manufacture of sugar in such a manner as to obtain a larger quantity from the beet, or who shall invent a more simple and economical method of manufacture, shall obtain a license for a longer time, with the assurance that no duty nor octroi shall be placed upon the product of his manufacture during the continuance of his license.

SECTION IV.—*Creation of four imperial factories.*

ART. 12. Four imperial beet-sugar factories shall be established in 1812 under the care of our minister of the interior.

ART. 13. These factories shall be so arranged as to produce with the crop of 1812 to 1813, 2,000,000 kilograms (4,409,200 pounds) of raw sugar.

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